

RF Measurement of First Batch of NLC CELL (I)

(FNAL NLC Tech Note 001)

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First batch of twelve NLC cells have been fabricated (diamond turning) by CMM (Contour Manufacturing & Metrology) Company. All of these cells are RDDS cell No. 50 (Fermilab Drawing No. A01 050.) Shown in Figure 1 are some of the cells. First round of RF measurement has been done recently. More measurements will be done for further study. This note describes the measurement results.

Shown in Figure 2 is the QC setup used for measurement. This QC setup was fabricated by Fermilab with SLAC drawings. All single cell measurements reported in this note are non-contact measurements, which means there is a gap of 0.0025 inch between cell and QC blocks. The reflection signals are used in single cell measurement, which is also the method used at SLAC. The temperature during the measurement is 77.5 F – 77.1 F.

Since non-contact measurement is sensitive to the gap between cell and QC blocks, it is necessary to check if there is any significant discrepancy in measurement results between the two labs. A Fermilab made trial cell was measured at both SLAC and Fermilab before. The results are very close: the fundamental 0 mode frequency is 10.44917 GHz measured at SLAC (at temperature of 70 F) and 10.449405 GHz measured at Fermilab (at temperature of 75 F).

Shown in Figure 3 are fundamental 0 mode frequencies of those twelve cells. Shown in Figure 4 are fundamental π mode frequencies. Shown in Figure 5 are first dipole π mode frequencies. Shown in Figure 6 are second dipole 0 mode frequencies. Fundamental 0 and π mode measurement was performed using an HP8722 Network Analyzer while first and second dipole mode measurement was performed using an HP8510 Network Analyzer. To maintain consistency, all cells were placed in a way that one of manifold hole was aligned with one of poles on QC setup. By doing this way, repeatability can be reached to within 0.25 MHz – 0.5 MHz. Even in this way, there is still evidence that the measurement result depends on the cell's orientation. Shown in Table 1 are frequencies (first dipole π mode) of cell A01 050 C008 measured as the cell was turned 90 degree in four steps. This will be studied further with contact measurement and may be used as information of cell imperfection.

Three cells C008, C010 and C011 were stacked and measured by using “contact” measurement which means that there is no gap between cell and QC Blocks. However the QC blocks are the same non-contact QC blocks which have chokes. In the future, pure shorting plates (QC blocks without chokes) will be used for contact measurement. Transmission signals were used for this measurement. Shown in Figure 7 are 0, $\pi/3$, $2\pi/3$ and π modes (first band) of a stack of three cells. Shown in Figure 8 is fundamental the

$2\pi/3$ mode of these three cells in small frequency span. The frequency of this mode is 11.4088 GHz.

Table 1. First Dipole π Mode Frequency of CELL C008 at Different Positions

Relative Position	Frequency (GHz)
Original Position	14.9375625
90 degree	14.9388125
180 degree	14.9384375
270 degree	14.9373750
360 degree	14.9381250, 14.9376875

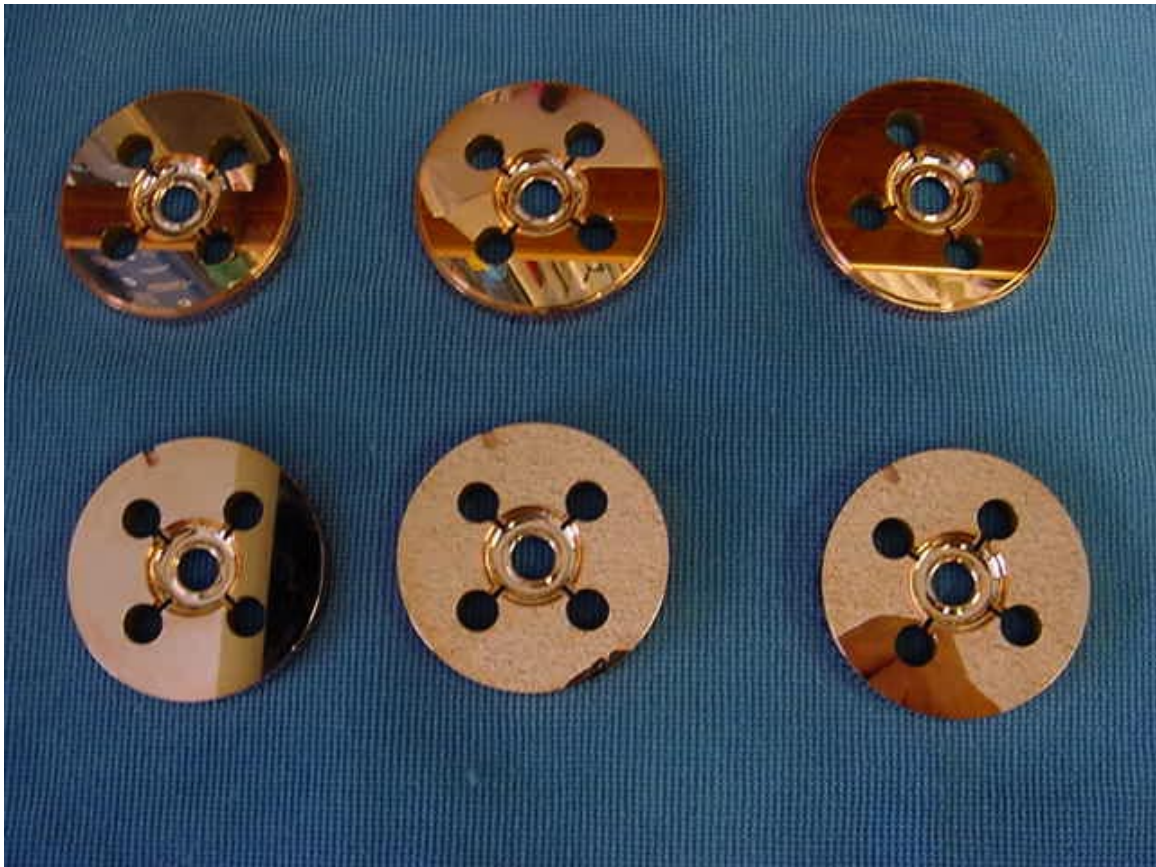


Figure 1. RDDS Cells Fabricated by CMM.

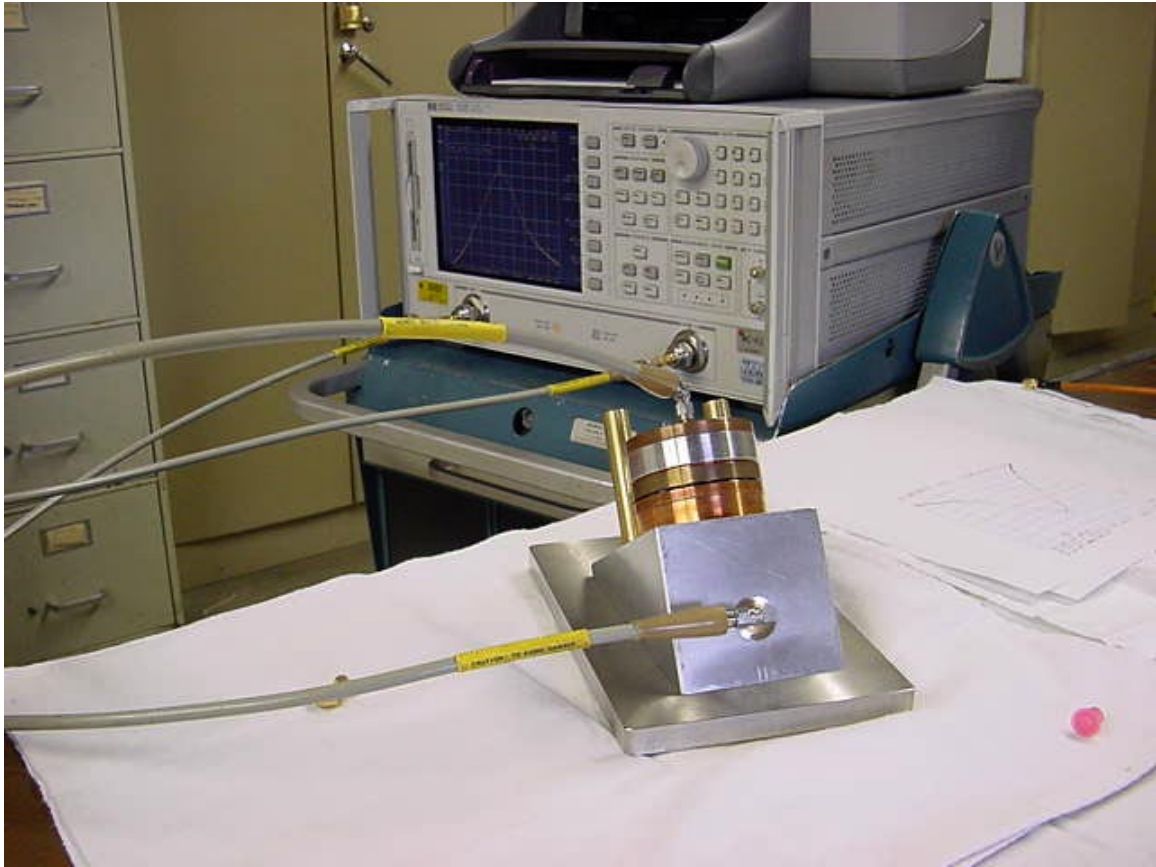


Figure 2. QC Setup

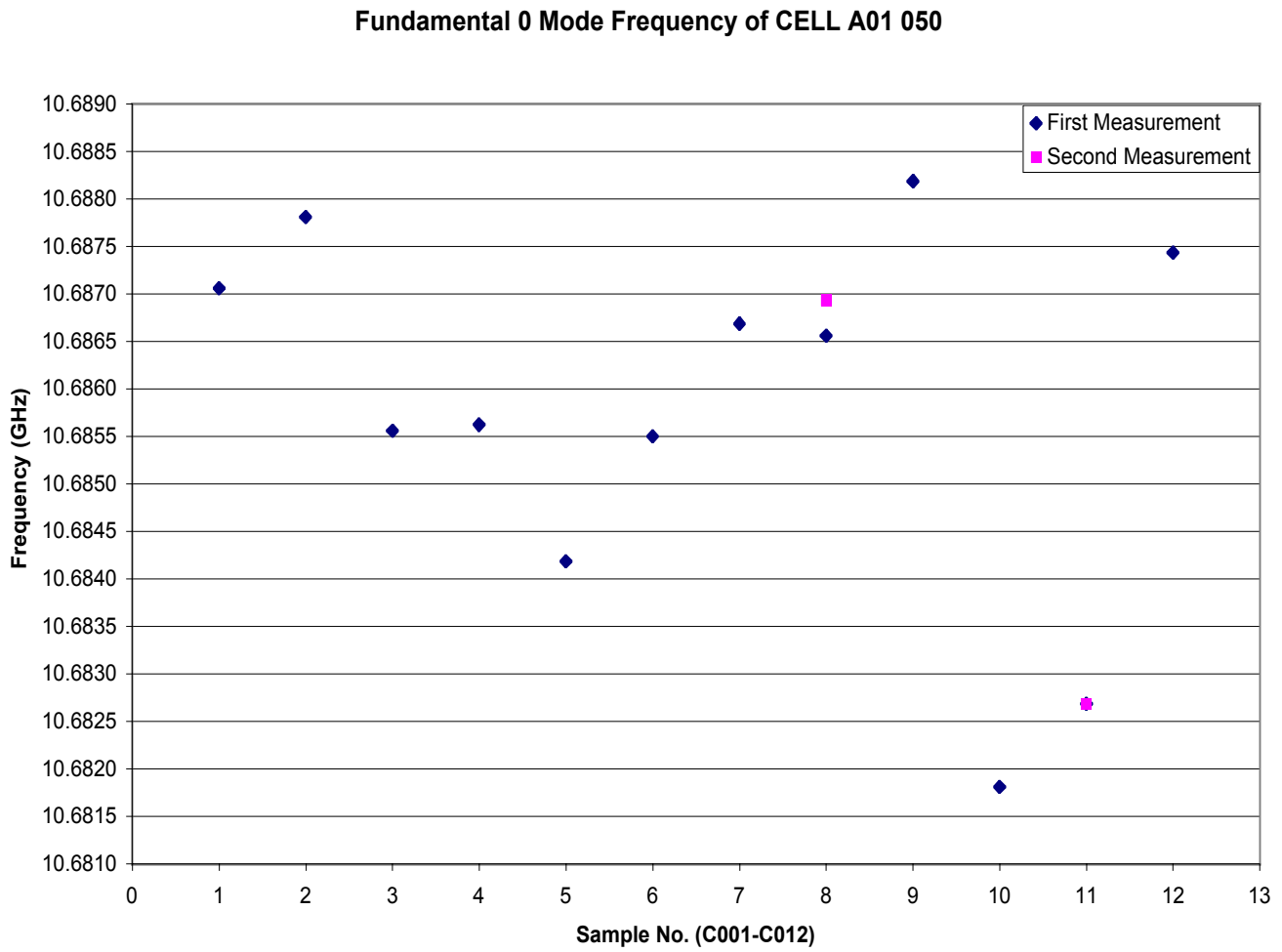


Figure 3. Fundamental 0 Mode Frequency (Cell A01 050 C001 – C012)

Fundamental π Mode Frequency of CELL A01 050

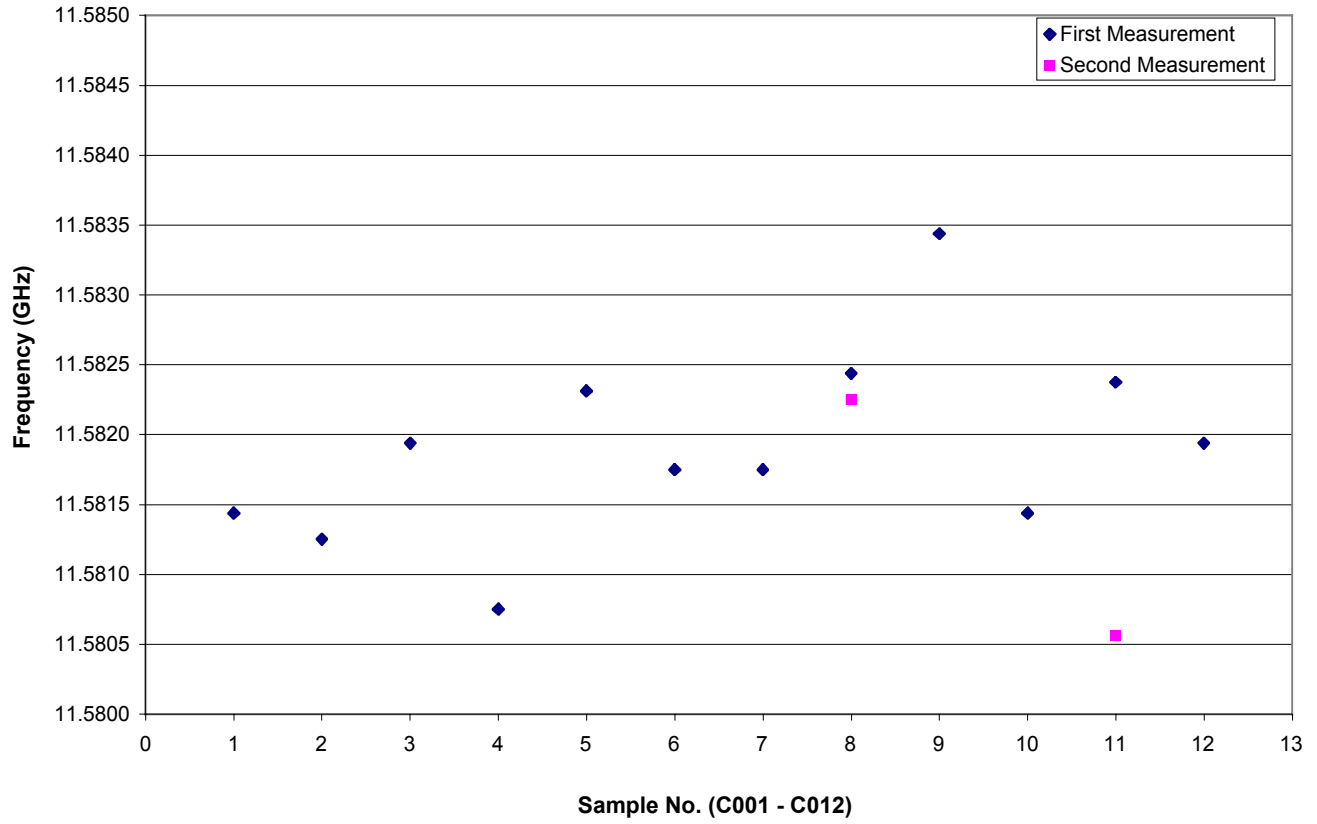


Figure 4 Fundamental π Mode Frequency (Cell A01 050 C001 – C012)

First Dipole π Mode Frequency of CELL A01 050

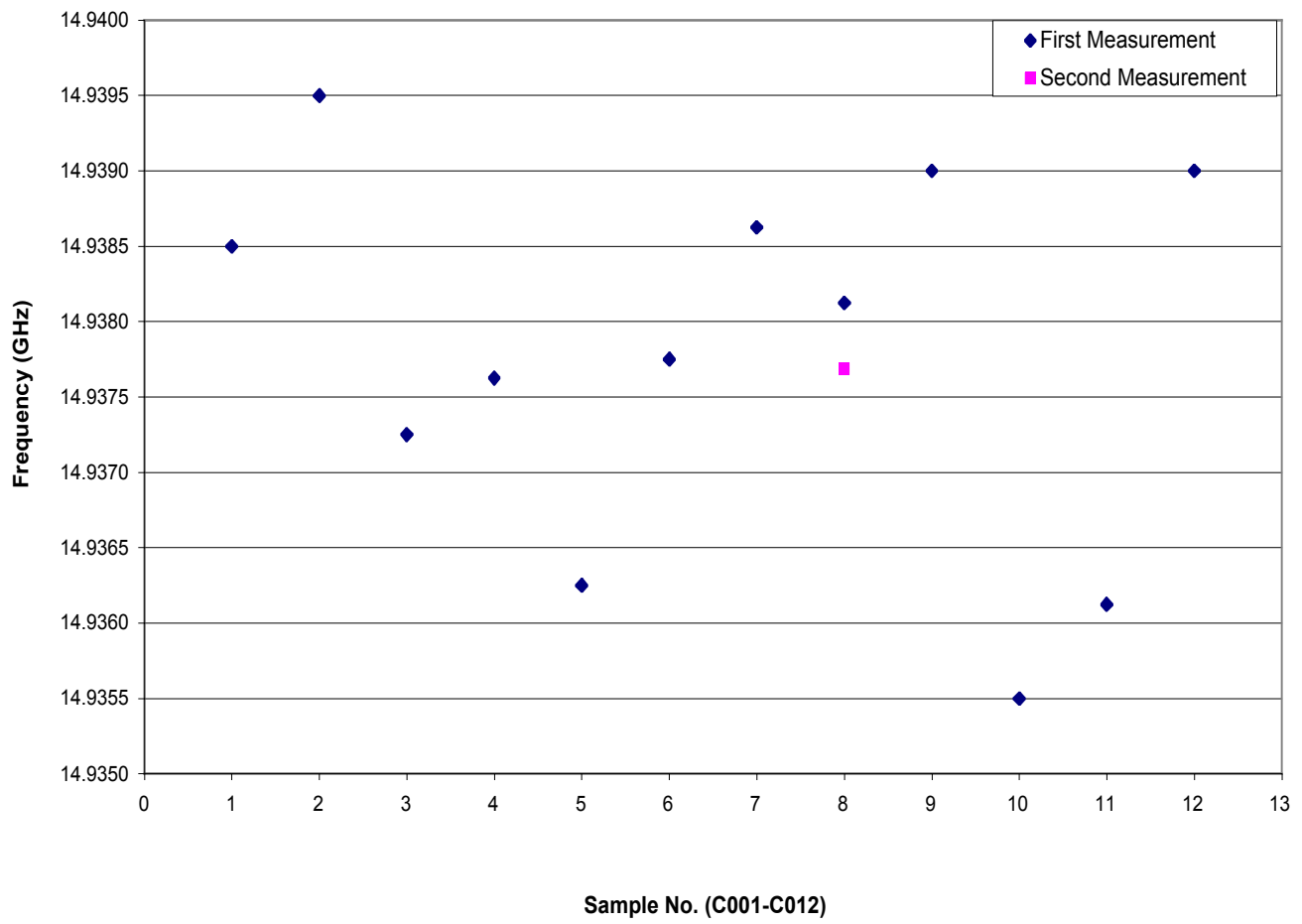


Figure 5. First Dipole π Mode Frequency (Cell A01 050 C001 – C012)

Second Dipole 0 Mode Frequency of CELL A01 050

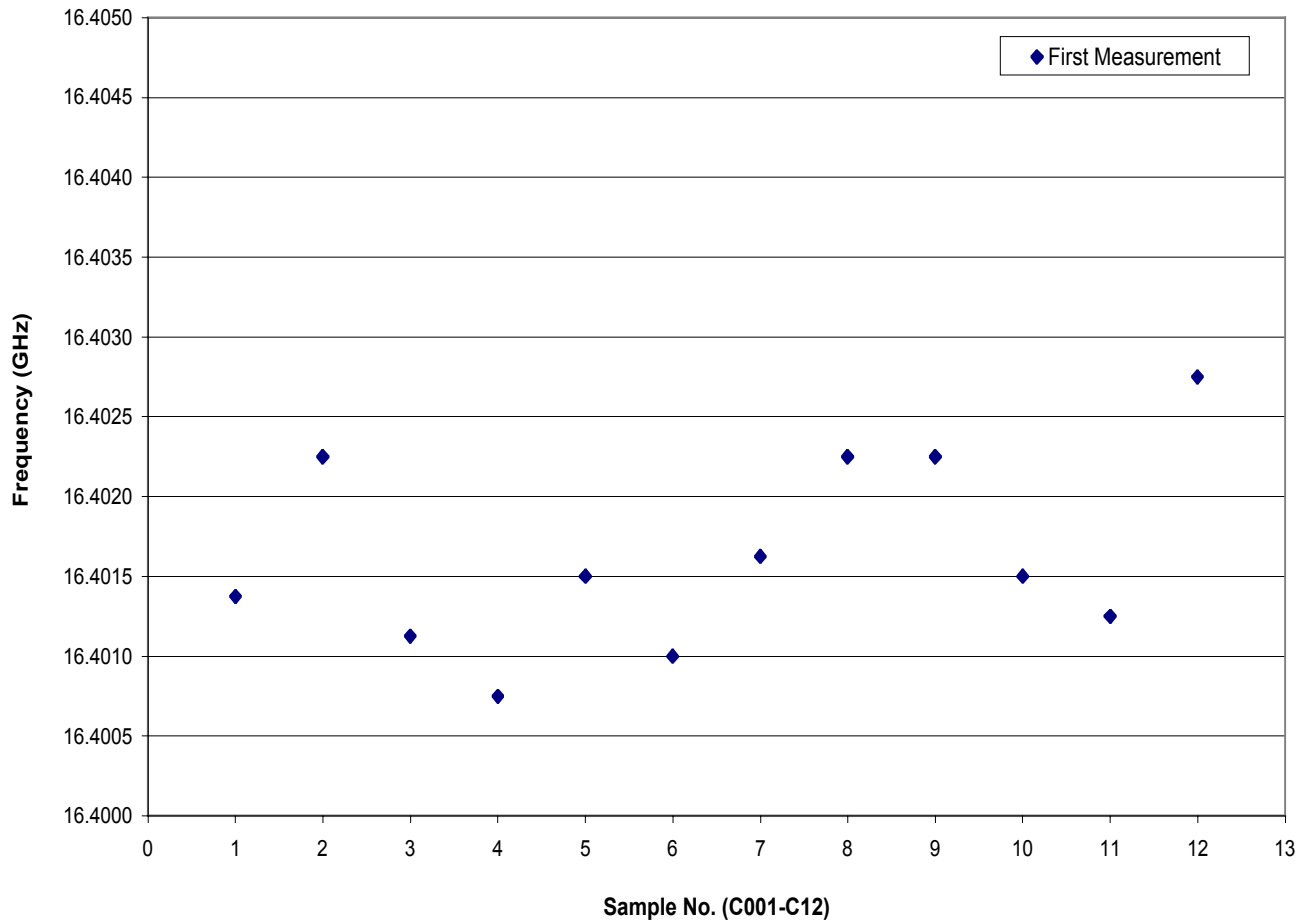


Figure 6. Second Dipole 0 Mode Frequency (Cell A01 050 C001 – C012)

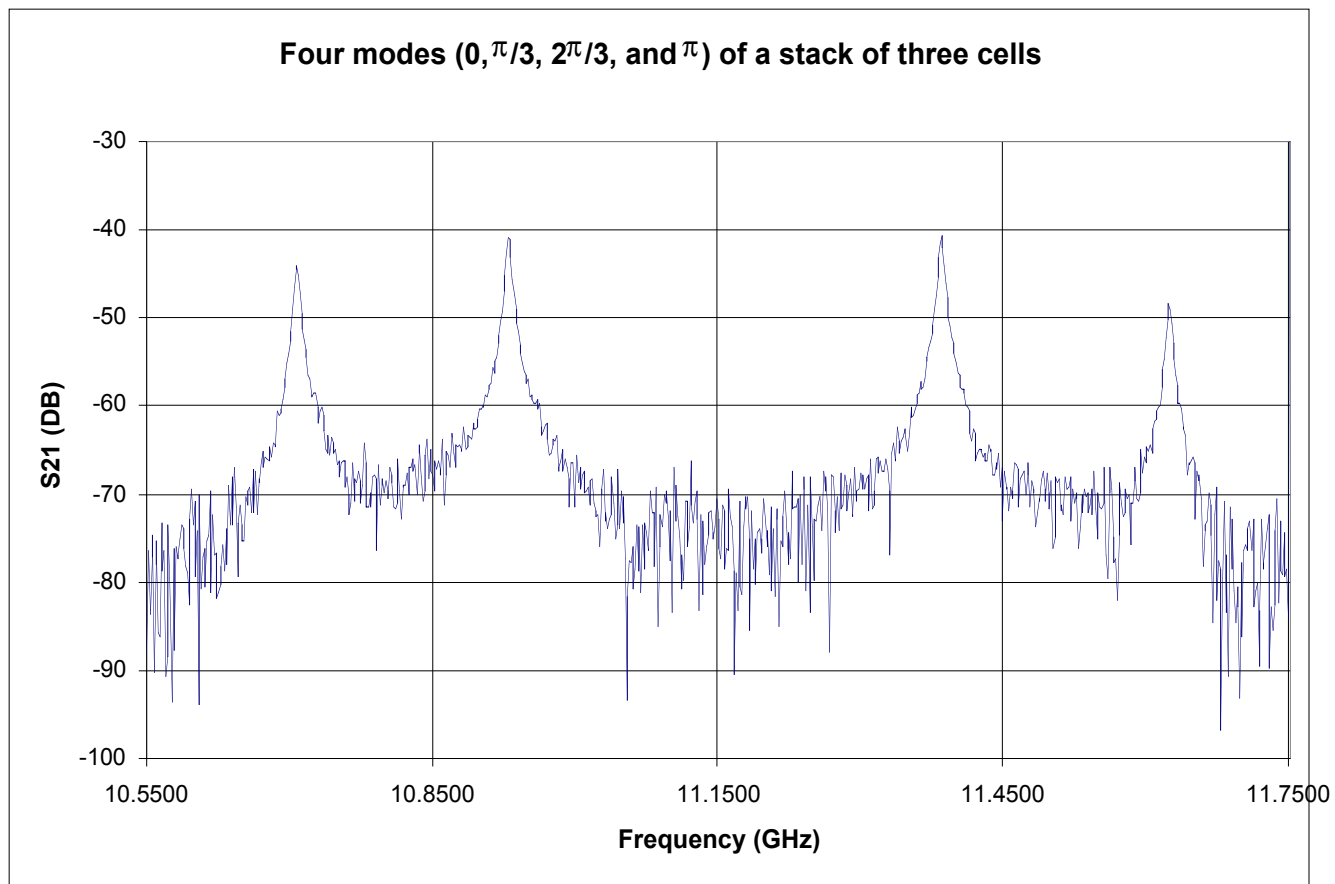


Figure 7. Four Modes ($0, \pi/3, 2\pi/3$ and π) (stack of three cells: C008, C010, C011)

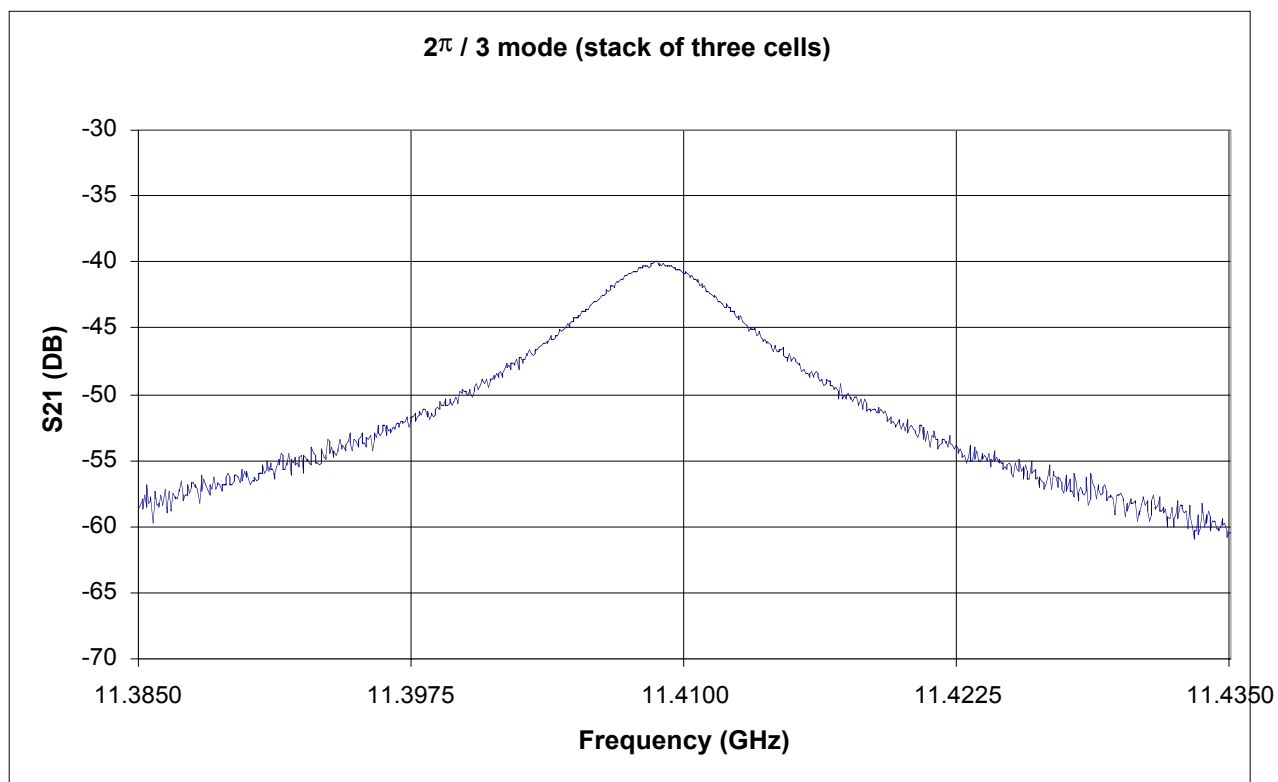


Figure 8. $2\pi/3$ Mode (stack of three cells: C008, C010, C011)